REMARKS

Reconsideration of this application, as amended, is respectfully requested.

The specification was amended to include a description for each of the figures. Support for the added text can be found in the specification at page 1, lines 27-30; and page 3, lines 31 to page 4, line 7. Accordingly, no new matter has been introduced into the application as a result of this amendment.

Claims 1-13 were pending in this application. These claims cancelled and replaced with new claims 14-29 to further clarify the invention. Support for the new claims can be found in the original claims and the specification at page 2, lines 21-29; and page 3, lines 20-28. No new matter has been added to the application as a result of this amendment.

Turning to the Office action, claim 1 stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus et al. (U.S. Patent No. 6,347,159)("Dapkus"). Claims 1-7, and 9-13 also stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus in view of so-called admitted prior art and of Xia (*Chem. Mater.* 1995, Vol. 7, pp. 2332-2337)("Xia"). Claims 1-13 further stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus in view of so-called admitted prior art, Xia, and Akahoshi et al. (U.S. Patent No. 5,294,291)("Akahoshi"). The Applicants respectfully traverse these rejections.

The Federal Circuit reiterated the manner in which obviousness rejections are to be reviewed. Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, "a proper analysis under § 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success." *In re Vaeck*, 947 F.2d 488, 493, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991), citing *In re Dow Chemical Co.*, 837 F.2d 469, 473, 5 U.S.P.Q. 2d 1529, 1531 (Fed. Cir. 1988). As the Federal Circuit emphasized by succinctly summarizing: "Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the Applicants' disclosure." *Id.* Contrary to the Examiner's position, neither Dapkus,

Xia, or Akahoshi, alone or in any combination, suggest doing what the Applicants have done.

The present invention relates to a method for recycling silver stained DNA chips having bound nanoparticles. As discussed in the application, the DNA detection chips are useful in nucleic acid hybridization assays for the detection of the presence of one or more target nucleic acids in a sample. See Figures 1 and 2 and the specification at page 2, lines 10-20. These chips include attached oligonucleotides that capture the target nucleic acid sequence under certain conditions. When low concentrations of target nucleic acid are present, nanoparticle-promoted silver reduction may be used to enhance the sensitivity of the chip and allow for facile detection of the bound target nucleic acid. See the specification, for instance, at page 2, line 21 to page 2, line 2. A serious limitation to silver reduction amplification is that silver stain cannot be readily removed from the DNA chip without damaging the chip (e.g., removing the oligonucleotides bound to the chip), thus preventing reuse of these expensive chips in additional hybridization assays. See the specification, for instance, at page 3, lines 16-19 and page 4, lines 8-12. The Applicants had surprisingly and unexpectantly discovered a solution to this problem by providing methods that would allow silver stained DNA chips to be recycled and reused in nucleic acid hybridization assays. Example 2 describes the removal of silver stain from a silver stained DNA chip using an etchant and reuse of the recycled chip in a hybridization reaction. See the specification at page 5, line 18. Example 3 describes the removal of silver stain using ultrasound waves and the reuse of the recycled chip in another hybridization assay. See the specification at page 6, line 6.

Contrary to the Examiner's position, neither Dapkus (primary reference), Xia, nor Akahoshi are remotely concerned with DNA chips having oligonucleotides bound thereto for the detection of target nucleic acids and the problem of regenerating these expensive chips after silver stain amplification for reuse of the chip in subsequent hybridization assays. Indeed, Dapkus, Xia, and Akahoshi relate to problems in the remote field of microelectronics, specifically solar module (Dapkus) and printed circuit board (Xia and Akahoshi) manufacture and to specific solutions to these problems.

(a) ***Dapkus***

Claim 1 stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus (primary reference). The Examiner alleged that since silver stained DNA detection chips are known and Dapkus teaches a method for recycling substrate, the present invention as claimed is not patentable. The Applicants respectfully traverse this rejection.

Dapkus relates to a method and apparatus for recycling expensive coated base substrates which serve as a foundation for selective buildup of coatings. See col. 1, lines 11-20. These base substrates are generally coated with semi-conductor coatings, metallic coatings or both and are used in the microelectronic industry such as in the manufacture of solar modules. Each coating is layered on a previous coating in successive steps. See Dapkus at col. 1, lines 34-52. If any applied coating is defective, the substrate is considered defective and is generally discarded. Id. This is particularly problematic in the manufacture of costly cadium telluride photovoltaic (CD Te PV) solar cell modules. See Dapkus at col. 1, lines 21-52, and line 66 to col. 2, line 9. To solve this problem, Dapkus developed a process by which select coating layers are stripped off, leaving the base substrate intact. See Dapkus at col. 1, lines 49-59; col. 3, lines 6-10; and col. 8, lines 35-39. For instance, Dapkus describes recycling of a solar module by his process which selectively dissolves cadium sulfide and cadium telluride layers of the module. See Dapkus at col. 3, line 38, to col. 9, line 25. The recovered base substrate can be reused for reapplication of new coatings. Thus, Dapkus is directed to a completely different problem and provides a solution specifically to that problem. Dapkus is completely silent with respect to the instant problem of recycling silver-stained DNA chips so that they can be reused for nucleic acid hybridization assays. An ordinary skilled artisan concerned with the problem of recycling silver stained DNA chips would not be motivated by Dapkus' teachings concerning recycling of solar modules by an etching process to make and use the presently claimed methods with any reasonable expectation of success. Xia and Akahoshi add nothing to Dapkus that can remedy the deficiencies in Dapkus' teachings. Accordingly, Dapkus cannot be properly applied to support a section 103(a) rejection of the claims. Withdrawal of the section 103(b)

rejection of claim 1 (now claim 14) based on Dapkus is in order and is respectfully requested.

(b) ***Xia***

Claims 1-7, and 9-13 stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus in view of so-called admitted prior art and of Xia (secondary reference). The Examiner alleged that Xia teaches a useful etchant for silver and that it would have been obvious to employ Xia's etchant with Dapkus' method and thus arrive with the claimed invention. The Applicants respectfully traverse this rejection.

The above comments concern Dapkus apply here was well. Xia adds nothing to Dupkus. Xia merely relates to an etching solution for use with patterned self-assembled monolayers (SAM) of alkanethiolates on gold. When exposed to etching solution, gold samples whose surfaces had been patterned with alkanethiolates, etching occurred predominantly in regions of bare gold. However, at the time intervals tested, evidence of pitting in SAM-covered regions was observed. See SEM photographs in Figure 1. Xia is merely concerned with developing new etchants for the selective etching of patterned gold, silver and copper surfaces without the problems associated with conventional etchants. See Abstract. Xia addresses this problem by providing an etchant having less toxicity, reduced hazards, lower environmental impact, and generates fewer defects during the etching process. Id. Xia is directed to a completely different problem and provides a solution specifically to that problem. Xia is completely silent with respect to the instant problem of recycling silver-stained DNA chips without damaging the chip so that the chip can be reused in further hybridization assays. Indeed, the observation of pitting of SAM-covered gold films would tend to teach away from the use of Xia's etchant in a method for recycling silver stained DNA chips for subsequent reuse in nucleic acid hybridization assays. Furthermore, Xia is completely silent with respect to the use of ultrasound waves. Thus, an ordinary skilled artisan concerned with the problem of recycling silver stained DNA chips would not be motivated by the combination of Dapkus' teachings concerning recycling of solar modules by an etching process and Xia's teachings concerning etching of patterned SAM-covered gold films and observation of pitting of SAM-covered gold films to make and use the presently

claimed methods with any reasonable expectation of success. Accordingly, the combination of the teachings of Dapkus and Xia cannot be properly applied to support a section 103(a) rejection of the claims. Withdrawal of the section 103(b) rejection of claims 1-7 (now claims 14-20) and claims 9-13 (now claims 22, and 27-29) based on the combination of Dapkus and Xia is in order and is respectfully requested.

(c) ***Akahoshi***

Claims 1-13 stand rejected under 35 U.S.C. section 103(a) as being unpatentable over Dapkus in view of so-called admitted prior art, Xia, and Akahoshi (secondary reference). The Examiner alleged that because Akahoshi teaches spraying etchant to a substrate, it would have been obvious to modify Dapkus' method with Akahoshi's spraying technique and Xia's etchant and thus arrive with the claimed invention. The Applicants respectfully traverse this rejection.

Like Xia, Akahoshi adds nothing to Dapkus. Akahoshi merely relates to a process for producing conductive circuit patterns on base metal formed on a substrate which is used for printed circuit board manufacture. According to Akahoshi, a plating resist is applied to copper clad laminates in a pattern. The patterned laminate is then exposed to etchant which selectively removes base copper metal not protected by the resist. The problem according to Akahoshi is to provide a resist material that sufficiently adheres to a substrate (in order to prevent delamination in the finished product) but can be completely peeled off at the resist peel-off step without damaging the underlying copper lines. See Akahoshi at col. 1, line 34 to col. 2, line 46. Akahoshi's solution is to treat the resist with a chemical stripper and then with a stripping residue remover. See Abstact. Thus, Akahoshi is directed to a completely different problem and provides a solution specifically to that problem. Akahoshi is completely silent with respect to the instant problem of recycling silver-stained DNA chips to remove silver stain without damaging the oligonucleotides bound to the substrate surface so that the DNA chip can be reused for DNA hybridization assays. While Akahoshi does describe the use of ultrasonic waves to remove stripping residue remover and the spraying etchant to a substrate at col. 3, lines 8-10, a disclosure of ultrasonic waves to remove a stripping residue and spraying etchant is not a disclosure or suggestion of the presently claimed

method for recycling a silver stained DNA chip for reuse in a subsequent hybridization assay.

Thus, an ordinary skilled artisan concerned with the problem of recycling silver stained DNA chips would not be motivated by the combination of Dapkus' teachings concerning recycling of solar modules by an etching process; Xia's teachings concerning etching of patterned SAM-covered gold films and observation of pitting of SAM-covered gold films; and Akahoshi's teachings concerning an etching process involving treatment of a plating resist with a chemical stripper and then with a stripping residue remover to make and use the presently claimed methods with any reasonable expectation of success. Accordingly, the combination of the teachings of Dapkus, Xia, and Akahoshi cannot be properly applied to support a section 103(a) rejection of the claims. Withdrawal of the section 103(b) rejection of claims 1-13 (now claims 14-29) based on the combination of Dapkus, Xia, and Akahoshi is in order and is respectfully requested.

(d) ***Conclusion***

In light of the above discussion, the Applicants respectfully submit that neither Dapkus, Xia, nor Akahoshi, alone or in any combination, teach or suggest the present invention as claimed. Withdrawal of the section 103(a) rejections of the claims is in order and is respectfully requested.

Prompt consideration and entry of this response is respectfully requested. The Examiner is invited to contact the undersigned representative if the Examiner believes that this would be helpful in expediting the prosecution of this application.

Respectfully submitted,

Date: 6-10-03

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